APEX CORPORATION

Chassis Design for Compact Television Receiver

Introduction

You are a member of a team of engineers that is designing a new transistorized television receiver for the Radio Corporation of Stanford. The receiver is aimed at the highly competitive, compact set market now being dominated by Sony.

Your team consists of both electrical and mechanical engineers. Once the electrical engineers have established the schematic drawing for the electronic circuitry, the two groups must work closely together to design the physical shape and size of the receiver so that it will function properly in an electronic sense, be reliable, be economical to manufacture, be pleasingly styled, and be easy to service. Throughout the period of the interdisciplinary activity, the electrical engineers must constantly consider lead lengths between various parts of the circuit, intercoupling between circuits, ease of wiring, ease of trouble-shooting, and heat dissipation from transistors and resistors.

Your project has progressed to the point where the team now has schematic diagrams for all the circuitry and has given careful consideration to the best way to continue the design of the receiver. You are the member who has been elected by your colleagues to handle the next phase of the design.

You and your team have already decided that you will package the receiver in a case nominally 7-5/8" wide, 4-1/4" high, and 7-1/4" deep. The TV picture tube will have a 4-3/4 x 3-5/8 screen size. The circuitry will be on three different decks, each in a horizontal plane, but separated vertically from one another. The lower deck will be made from 20 gauge sheet aluminum and will both support the heavy components and serve as a heat sink for all power transistors. The other two decks will be made from 1/16" thick phenolic laminated plastic sheet--a material suitable for printed circuitry. The top deck will have the loudspeaker mounted in it so that the sound will come out of the top of the cabinet.

Assignment

Specifically, you have the following assignment:

1. Redraw the Base Frame (dwg. 100) and dimension the required holes to provide physical support for:

   a) two front controls (dwg. 101) - volume control and picture contrast control

   b) three rear controls (dwg.101) - picture brightness, horizontal hold, and vertical hold.

2. Detail a 20 gauge (.0320) 7-5/8 by 7-1/4 sheet of aluminum (deck 1) to have an appropriate cut out for the picture tube (dwg. 102) and mounting holes for the following:

   a) Channel Selector (dwg. 103)
   b) Power transformer (dwg. 104)
   c) Two power transistors (dwg. 105)
   d) One filter capacitor (dwg. 106)
   e) Front mount for the picture tube (dwg. 107)
   f) Rear mount and deflection coil (dwg. 108)
   g) 1/4" diameter spacers as you deem necessary to support the two phenolic decks.

3. Detail a sheet of .0625 $\pm$ .005 phenolic laminated plastic (deck 2) to be supported, on spacers, 1-1/4 inches above deck 1. This deck should have as large a clear surface areas as possible to accommodate the printed circuitry layout that will be done after you have finished your phase of the work. Avoid long thin sections of circuit board.

4. Detail another sheet of plastic (deck 3) to be supported 2" above deck 2. This deck should have a cutout to accommodate the loud speaker (dwg. 109) and should also have as large an areas as possible for the printed circuitry.

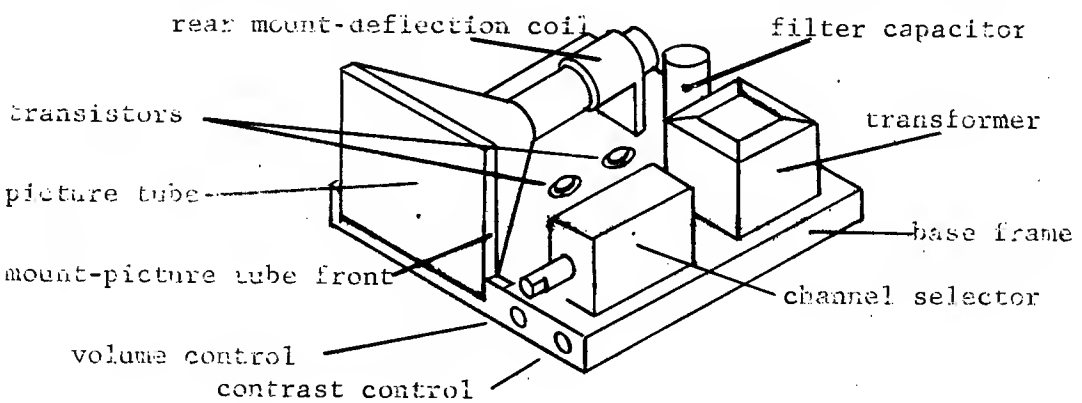
5. You are to prepare the following full size drawings:

   a) Layout - overall design
   b) Detail - base frame
   c) Detail - deck 1
   d) Detail - deck 2
   e) Detail - deck 3
   f) Detail - spacer (use only one dwg. for both lengths)
   g) Assembly and Bill of Material - complete - including dwgs. 100-109.

   Note: Hand in Dwgs. 100-110 with your other drawings. Do not include machine screws, nuts, or washers in your assembly drawing.

General Information

One possible layout for the television set is sketched below:



Dimensioning for mounting hardware should be standardized throughout the design to accommodate 4-40 screws which have a maximum major thread diameter of 0.112 inches and a nominal head diameter of 0.219 inches.

The choice of distances between decks is based upon the spacing required to minimize unwanted coupling between various portions of the circuitry in the receiver. The significance of this statement may become clearer if we take a quick look at the principle of operation of a television system.

Camera

The scene to be televised is focused, by means of suitable lenses, on the photoconductive-layer surface of a camera pickup tube. The resulting image is scanned by an electron beam in the camera tube, the amount of light the beam encounters at any instant determining the magnitude of electron beam current. As a result of the camera tube scanning process, an output voltage proportional to the light intensity is obtained. The output voltage thus generated is called the video signal.

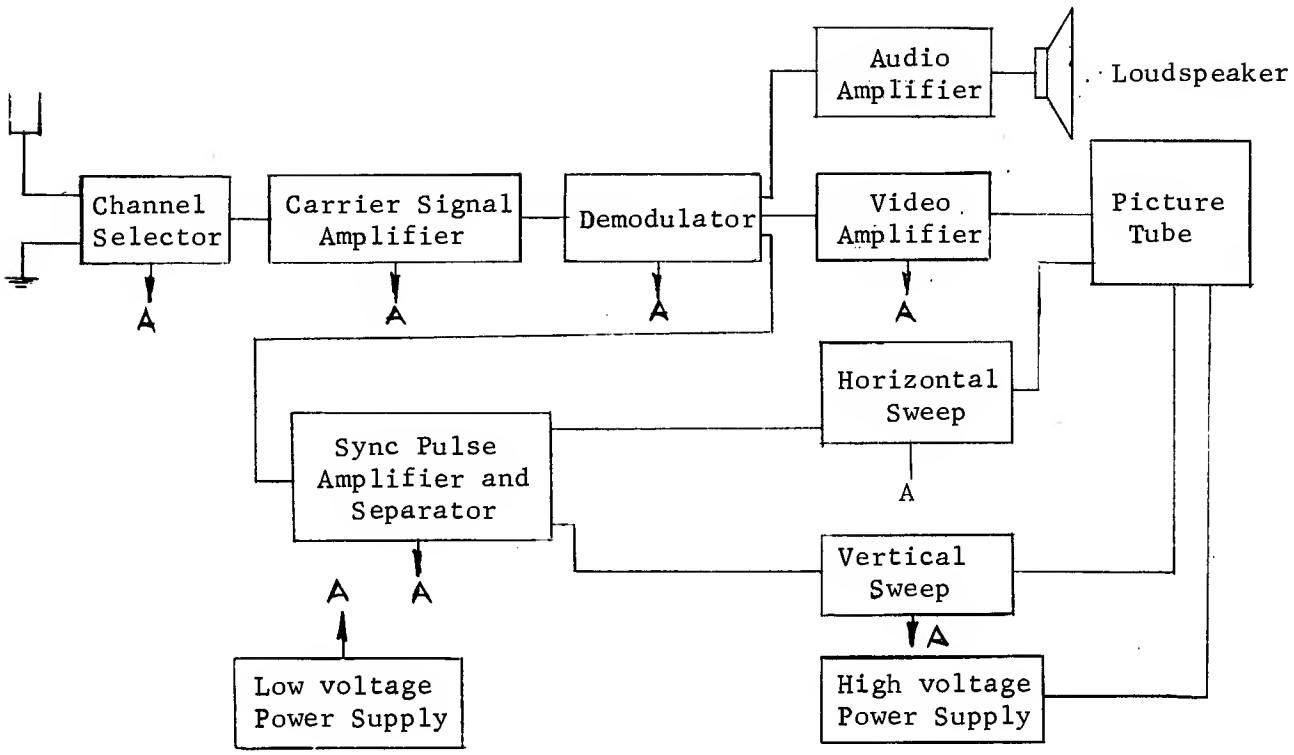
The video signal can be converted back to a visual image again by using the signal to vary the electron beam current of a television picture tube. It must be recognized, however, that the rate of sweeping of the picture tube beam from left to right and from top to bottom must have an identical time relationship to the video signal that said signal had in respect to the scanning rate in the camera tube. This problem is resolved by feeding synchronizing pulses along with the video information, from the television camera to the television picture tube. The "sync pulses", as they are called, lock the horizontal sweep circuitry of the receiver (left-right deflection) to the camera signal; the receiver has an adjustment called the "horizontal hold" control which can be adjusted to compensate for variations in tolerances of electronic parts in the receiver. The "sync pulses" also lock the vertical sweep circuitry of the receiver (top-bottom deflection) to the camera signal; the receiver has a "vertical hold" control to compensate for tolerance difficulties.

The system outlined is typical of closed circuit television systems, and in principle is identical to the relationship between a camera and a home TV receiver picture tube.

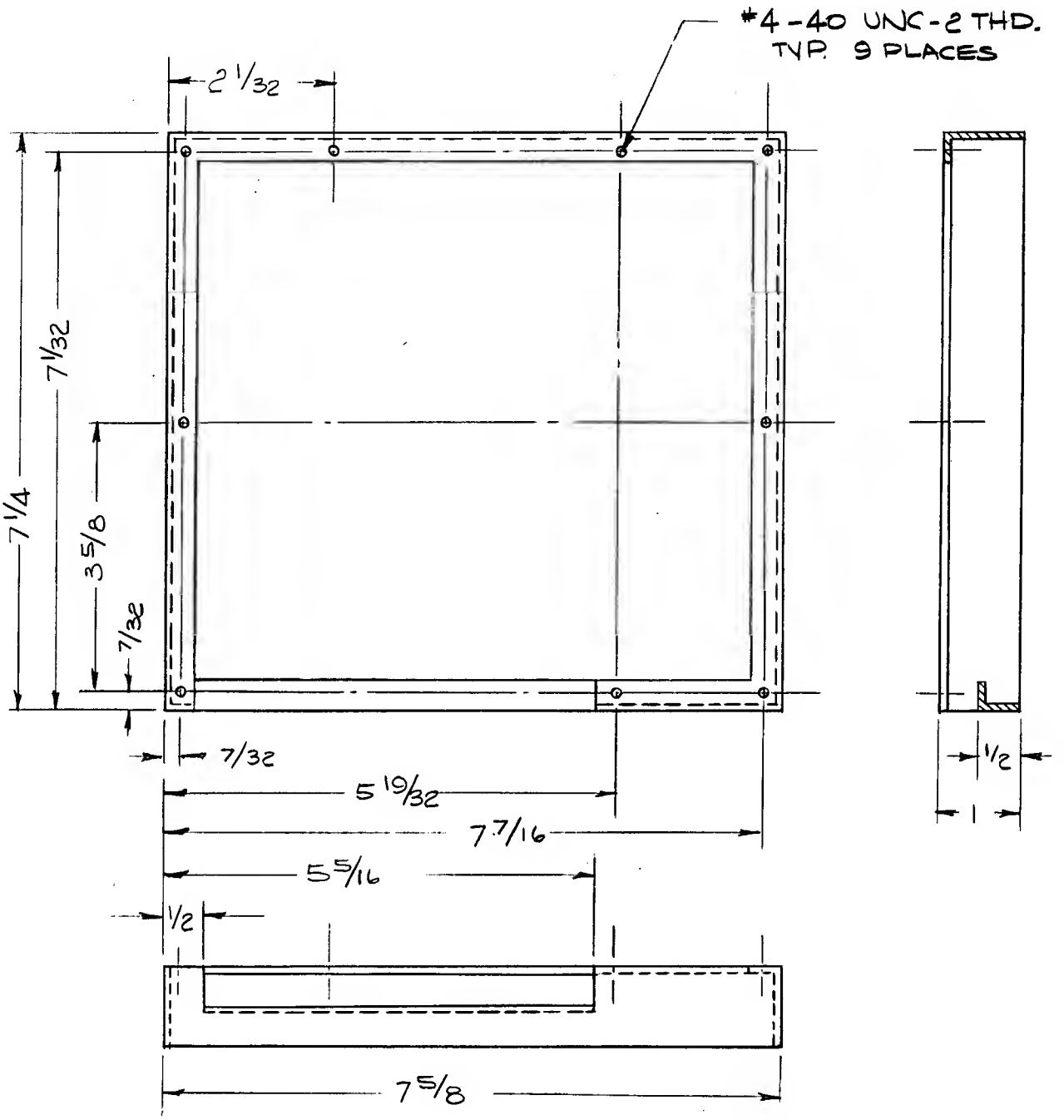
If we go back to the original video signal from the camera (complete with sync pulses), this signal can be used to modulate a very high frequency carrier signal. Channel 5, for example, broadcasts on a carrier that is in the range of 76-82 megacycles. The modulated carrier is then picked up by the television antenna and said carrier is "received" by the television set if the set is tuned to the respective frequency (i.e., Channel 5); otherwise, the carrier is rejected.

A carrier that is "received" is then demodulated to once again obtain both the video signal from the camera and the corresponding sync pulses. In a similar manner the audio signal is also obtained.

The block diagram of the receiver you and your team are designing is as follows:

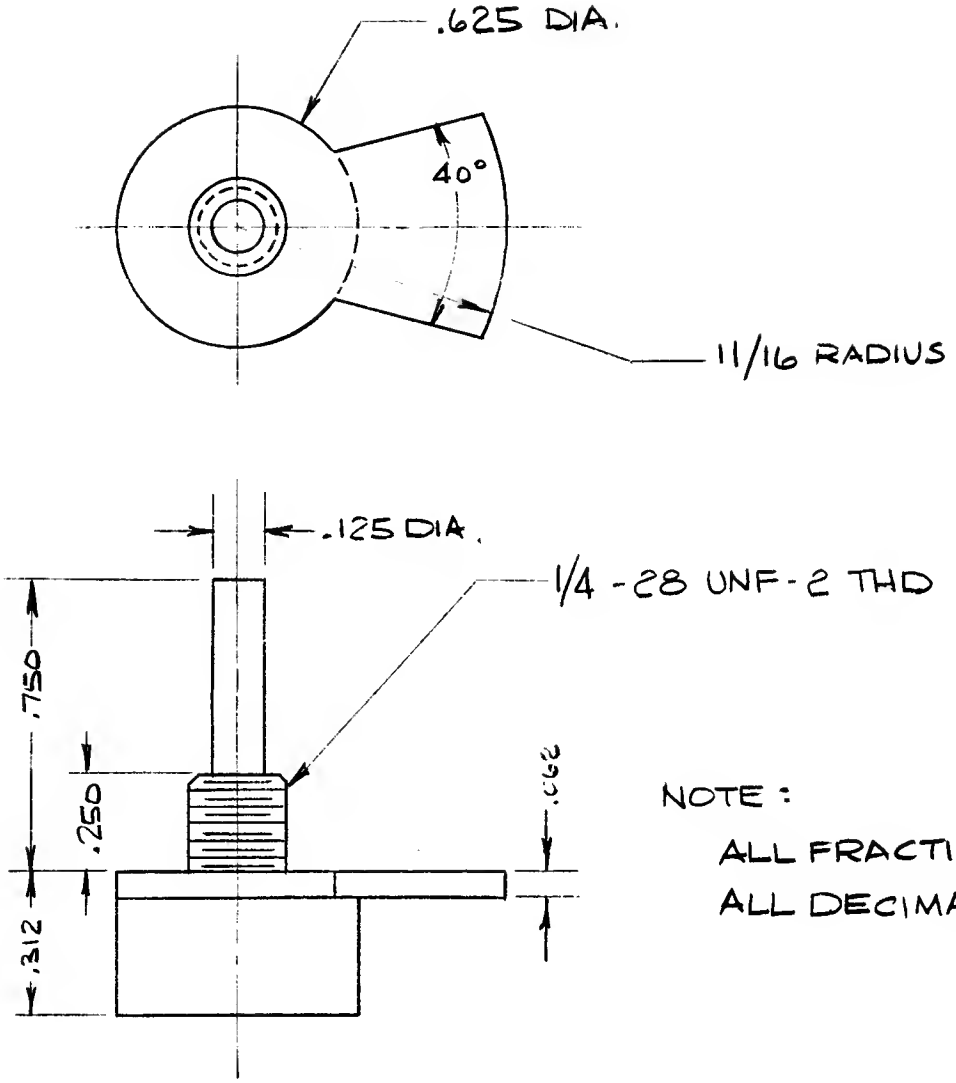


The block diagram shows the many different circuit functions that exist simultaneously in a television receiver. This situation dictates that care be exercised in controlling coupling between the various circuits. Care must also be exercised in controlling the 8,000 volt high voltage power supply in your design.



NOTE: ALL DIMENSIONS ARE ± 1/64

DWG. 100
BASE FRAME - DECK 1
SCALE: HALF SIZE



NOTE :

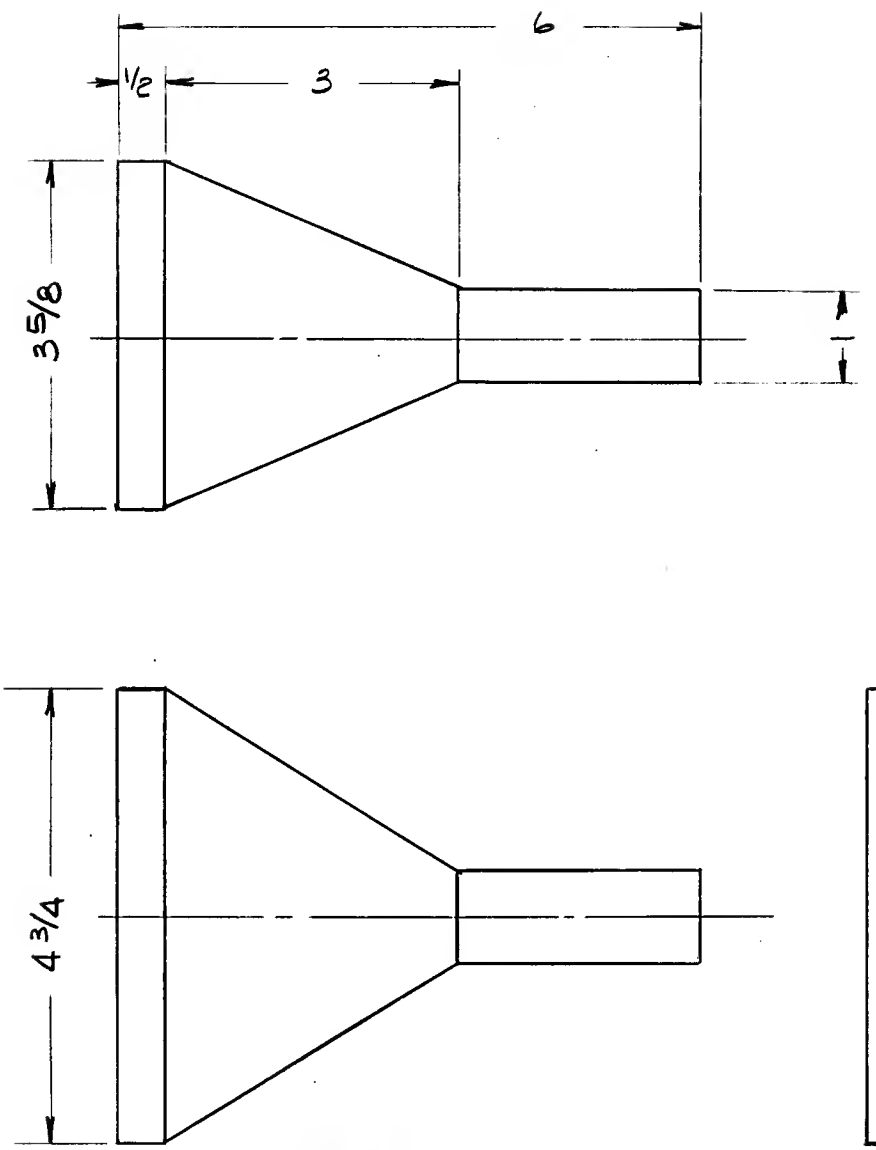
ALL FRACTIONS ±1/64

ALL DECIMALS ±.005

DWG. 101

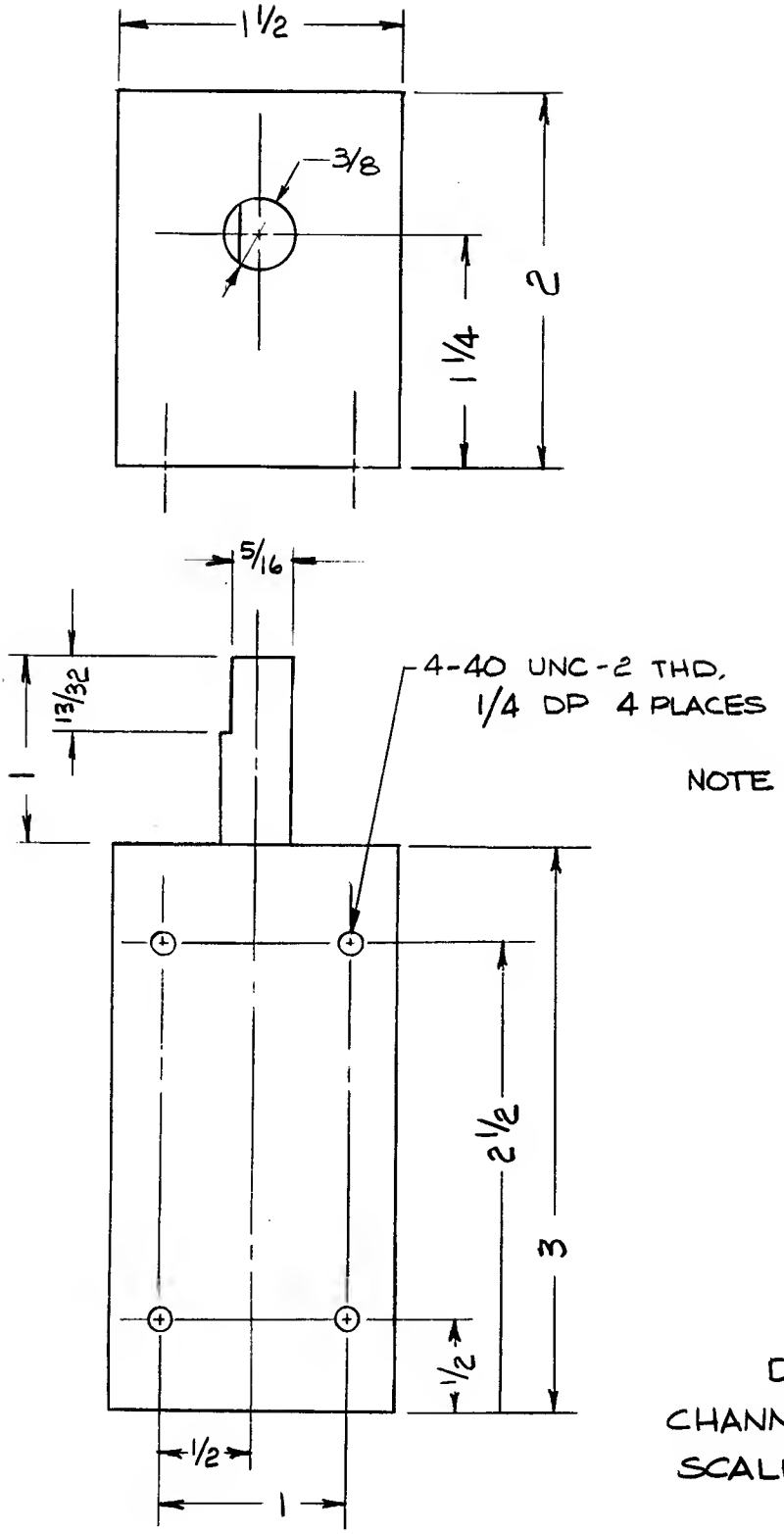
CONTROL - POTENTIOMETER

SCALE : DOUBLE



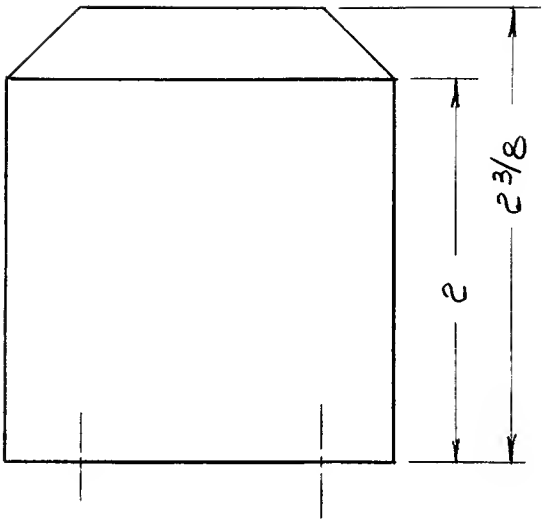
NOTE : ALL DIMENSIONS ARE $^{+\ 0}_{-\ 1/64}$

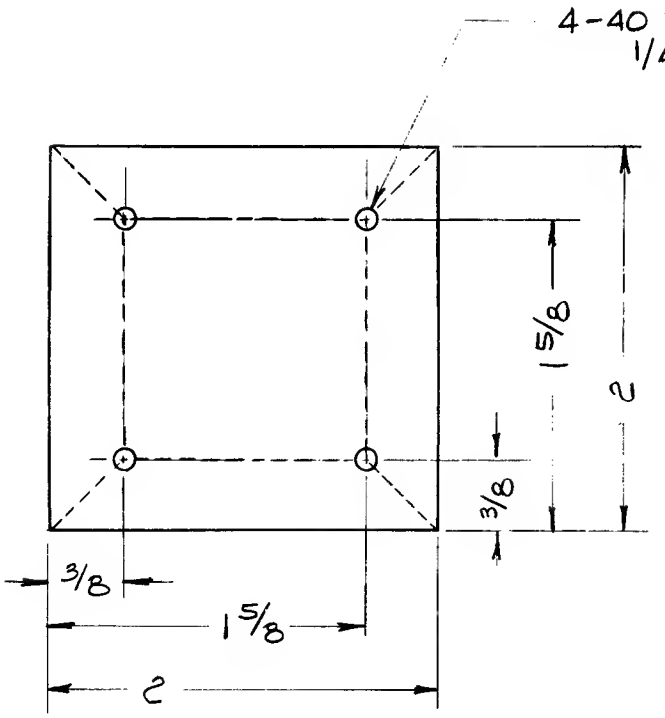
DWG. 102
TV PICTURE TUBE
(IDEALIZED)
SCALE : HALF SIZE



NOTE: ALL DIMENSIONS ARE ± 1/64

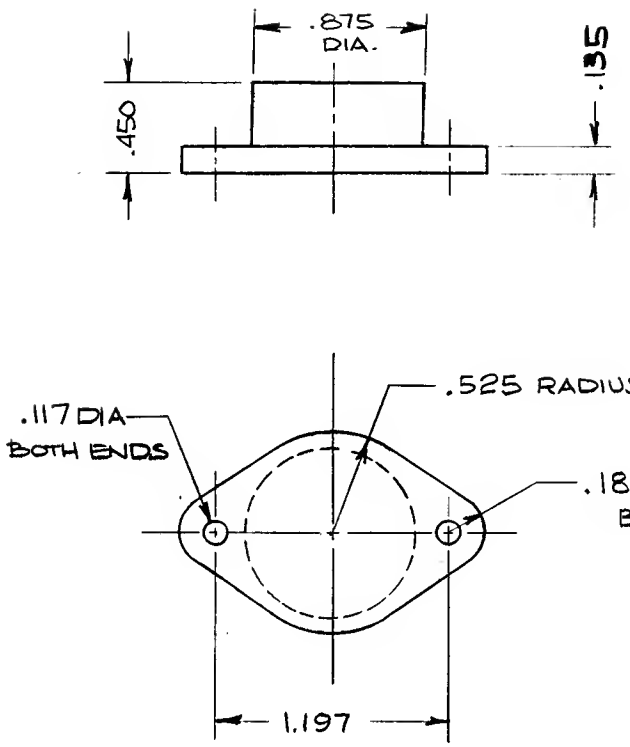
DWG 103
CHANNEL SELECTOR
SCALE: FULL SIZE





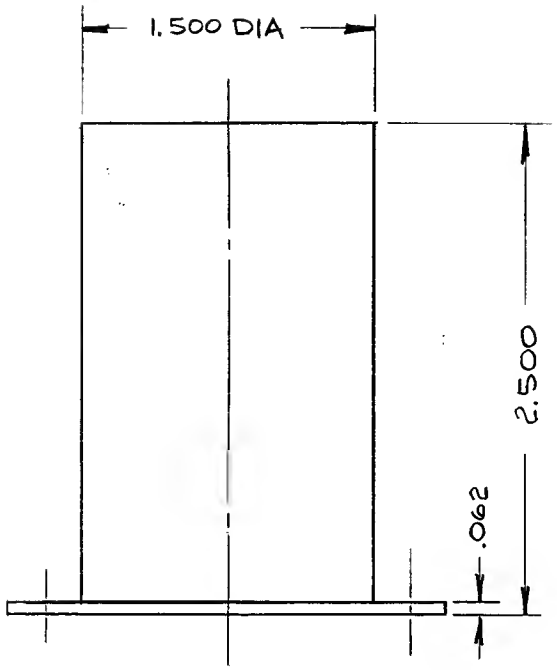
NOTE : ALL DIMENSIONS ARE ± 1/64

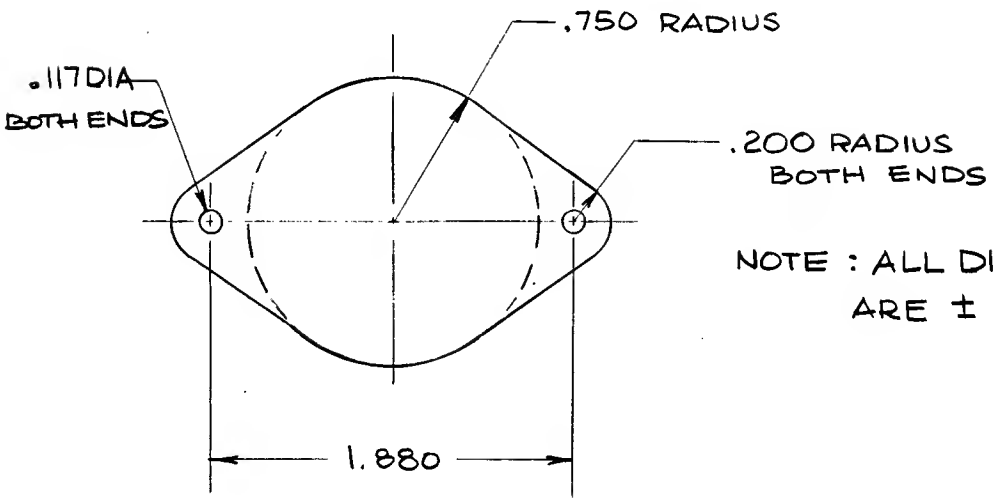
DWG. 104
POWER TRANSFORMER
SCALE : FULL SIZE



NOTE : ALL DIMENSIONS
ARE ±.005

DWG. 105
POWER TRANSITOR
SCALE : FULL SIZE



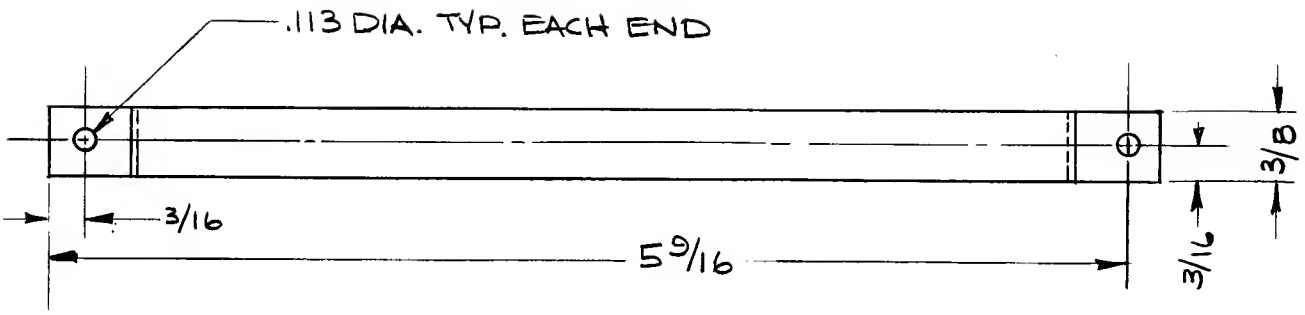


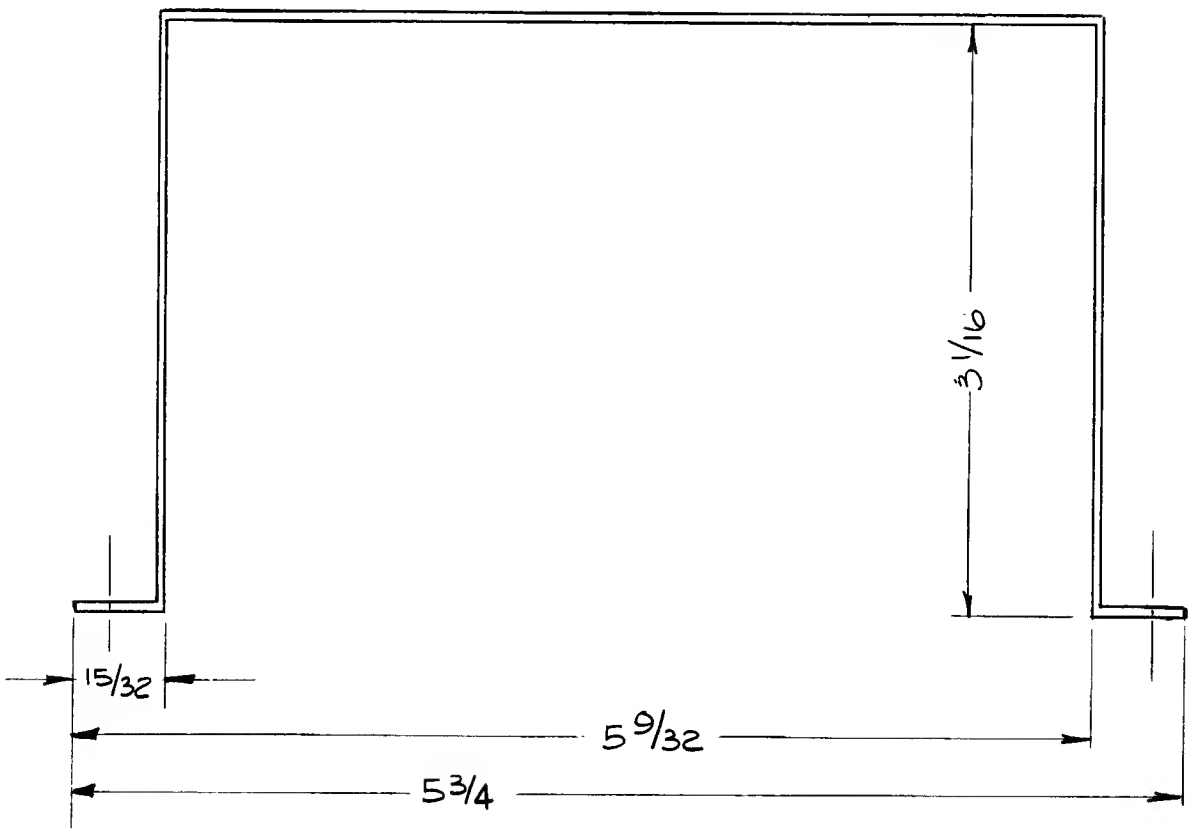
NOTE : ALL DIMENSIONS ARE ± .005

DWG. 106

FILTER CAPACITOR

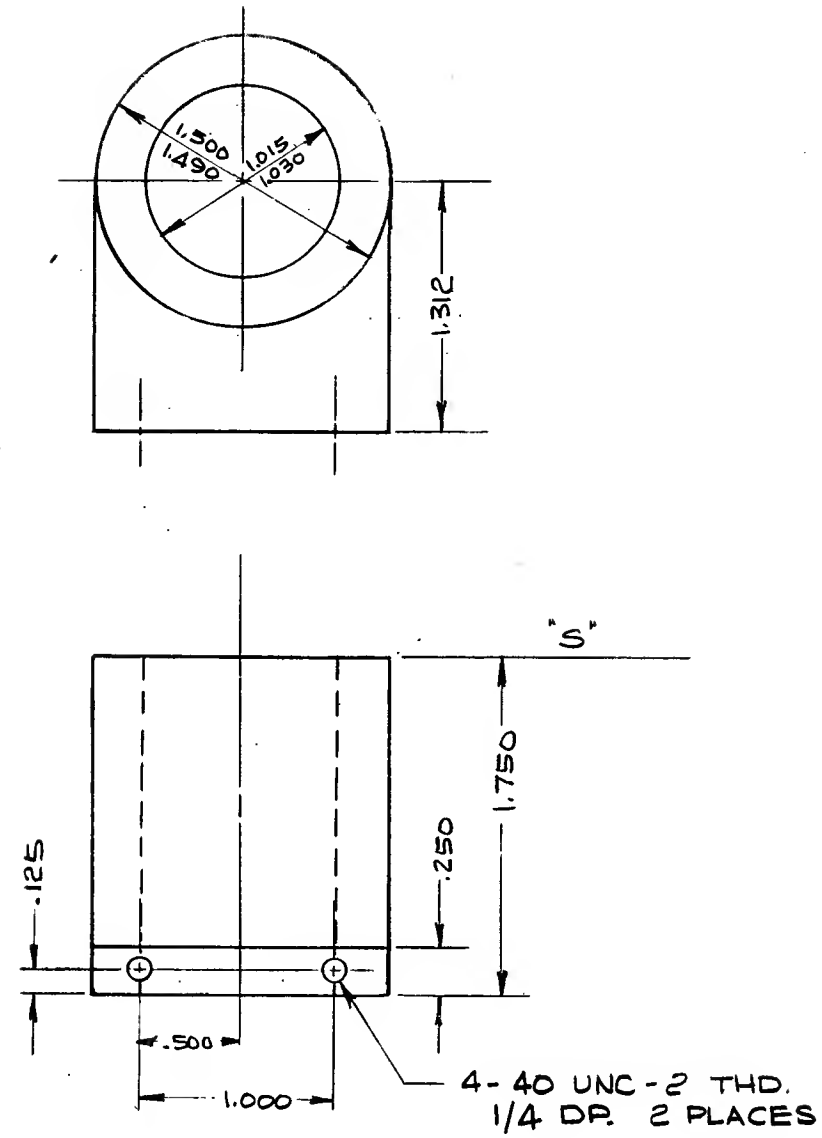
SCALE : FULL SIZE





NOTE: TOLERANCES ON FRACTIONS ARE ± 1/64 ON HOLES ± .001

DWG. 107
MOUNT - PICTURE TUBE FRONT
SCALE: FULL SIZE
MATERIAL : 14 GAUGE ALUMINUM



NOTES:

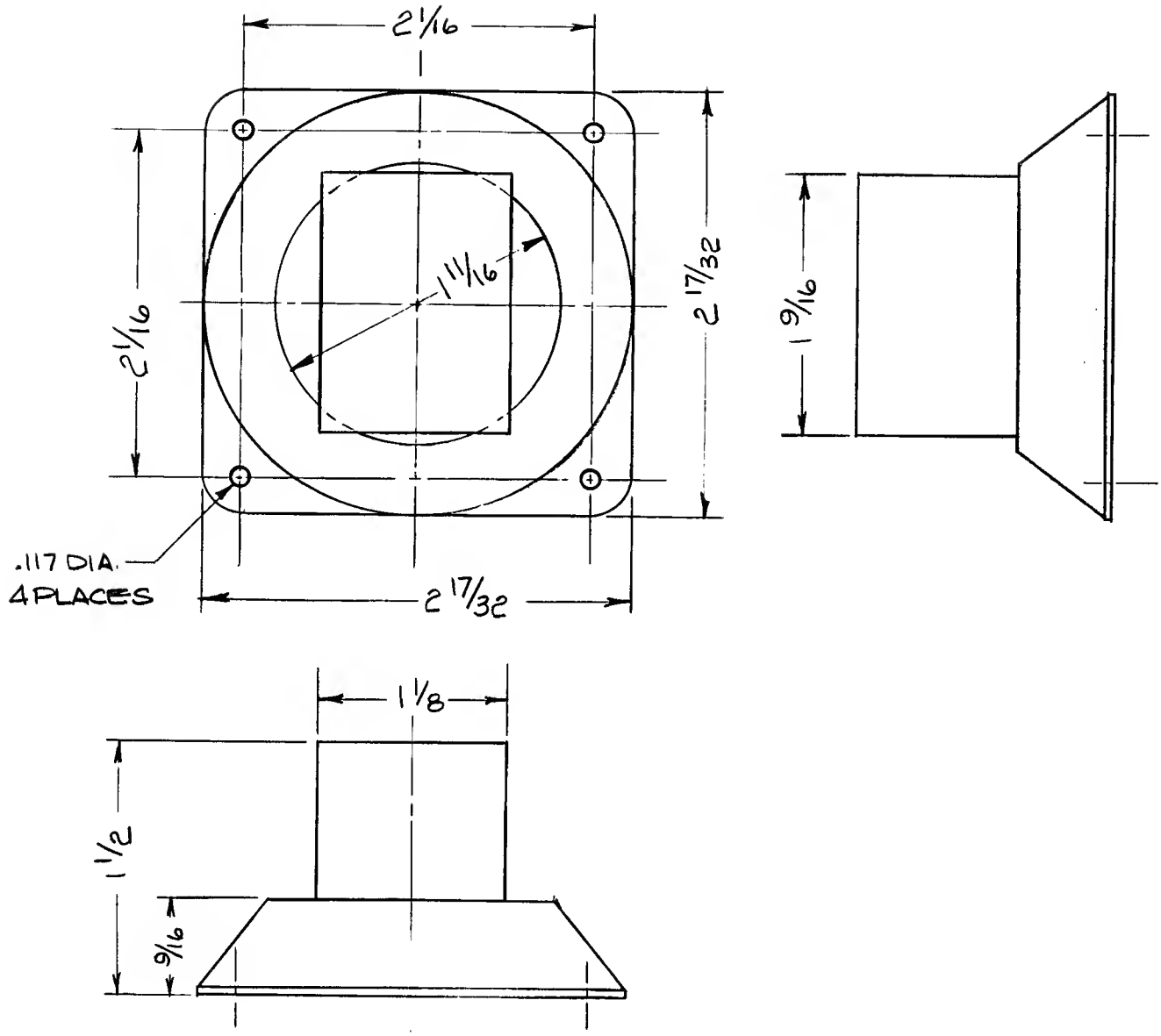
1- SURFACE "S" SHOULD BE LOCATED AS CLOSE TO THE PICTURE FACE AS POSSIBLE

2- ALL DIMENSIONS ARE ± .005 UNLESS OTHERWISE STATED.

DWG. 108

REAR MOUNT/DEFLECTION COIL - PICTURE TUBE

SCALE : FULL SIZE



NOTE : ALL FRACTIONS ± 1/64
ALL DECIMALS ± .005

DWG. 109
LOUD SPEAKER
SCALE : FULL SIZE